

IoT-Enabled Rural Water Supply Scheme in Punjai Palatholuvu Panchayat, Erode district

Background

Rural water supply systems in Tamil Nadu are primarily implemented through single-village and multi-village schemes by the Rural Development and Panchayat Raj Department. However, many Gram Panchayats face difficulties in meeting the full water demand of their populations due to source limitations, infrastructure constraints, and operational inefficiencies. Water is often supplied intermittently, with quantities falling below the Jal Jeevan Mission service-level benchmark of 55 LPCD. Typically, water is supplied up to the overhead tank (OHT) by the TWAD Board, while Gram Panchayats manage distribution to households through locally appointed operators, often with limited financial and technical resources. When TWAD Board supplies are inadequate, Panchayats depend on alternative sources such as groundwater, ponds, and other surface water bodies, where water quality is generally less assured.

Despite progress in Functional Household Tap Connections, challenges remain in ensuring reliable, safe, and efficient service delivery. Intermittent supply, inadequate water quality monitoring, OHT overflows, undetected leakages, and dependence on manual pump operation contribute to water losses, irregular timings, human errors, and inefficient energy use. Limited skilled manpower further constrains effective operation and maintenance.

IoT-based smart water management offers a transformative solution through real-time monitoring, automation, and data-driven decision-making. IoT-enabled sensors and automatic chlorinators enable continuous monitoring of water quality, levels, flow, and system performance, while automated controls regulate pumping, prevent overflow, and support scheduled and equitable distribution. These systems also optimize energy consumption, reduce operational costs and water losses, and minimize manual intervention. Integration with centralized dashboards enhances transparency, accountability, remote supervision, and timely corrective action, providing a scalable pathway toward resilient, efficient, and sustainable rural water supply management.

M/s Severn Glocon Valves Pvt. Ltd. (SGVPL), as part of their CSR (Corporate Social Responsibility) activities, sponsored the project: **“Providing IoT-Based Smart Water Management System with Auto Chlorination & Water Quality Monitoring for OHTs in Punjai Palatholuvu Panchayat, Erode district.”** AquaMAP: Center for Water Management and Policy at IIT Madras coordinated the implementation of this project.

Goal of the Project

The main purpose of this project was to integrate the Internet of Things (IoT) into the existing rural water supply scheme to enable a reliable and efficient water supply to stakeholders. IoT was leveraged for;

- Continuous monitoring of water quantity (levels in OHTs, amount of water supplied) and

essential water quality parameters (pH, Turbidity, Residual chlorine concentration, and Total Dissolved solids);

- Automatic control of pumping operation to minimize water loss due to OHT overflowing and energy optimization;
- Automatic chlorine dosage in case of deterioration in water quality and
- making the consumers completely aware of the quality of water supplied to them and enabling them to register their complaints or special requests.

Also, the integration of IoT brings significant transparency in the system management and stakeholder involvement, leading to sustainability.

Why was this Panchayat Selected?

A systematic multi-criteria process was adopted to select a suitable site for implementing the IoT-based rural water supply system. Potential Panchayats were shortlisted based on water supply challenges, population served, source dependency, infrastructure condition, and operational status. Priority was given to locations experiencing intermittent supply, water losses, manual operation, and inadequate monitoring. Field assessments evaluated infrastructure condition, accessibility, power availability, and feasibility of sensor installation and automation, supported by consultations with District Administration, engineering staff, Panchayat officials, operators, and community representatives. Based on these assessments, Punjai Palatholuvu Panchayat near SIPCOT, Perundurai, was selected due to significant water scarcity, limited usability of surface water sources affected by industrial activities, irregular drinking water supply, and manual system operation. Water-quality samples from the source, sump, OHT, and distribution points were analyzed for physico-chemical and microbiological parameters, identifying monitoring gaps and the need for real-time surveillance. Stakeholder consultations further highlighted operational, manpower, and energy-efficiency challenges and confirmed readiness for automation.



Map of Punjai Palatholuvu Panchayat

Brief Details of the Panchayat

Punjai Palatholuvu is a gram panchayat located in Perundurai taluka of Erode district in Tamil Nadu, India. The Gram Panchayat covers 17 habitations spanning a total geographical area of 1477.23 hectares and is situated 23 km away from sub-district head quarter Perundurai (Tahsildar office) and 36 km away from district headquarter Erode. Chennimalai is the nearest town to Punjai Palatholuvu for all major economic activities. The Panchayat, consists of 867 households and a population of 2058.

Status of Water Supply System Prior to Intervention

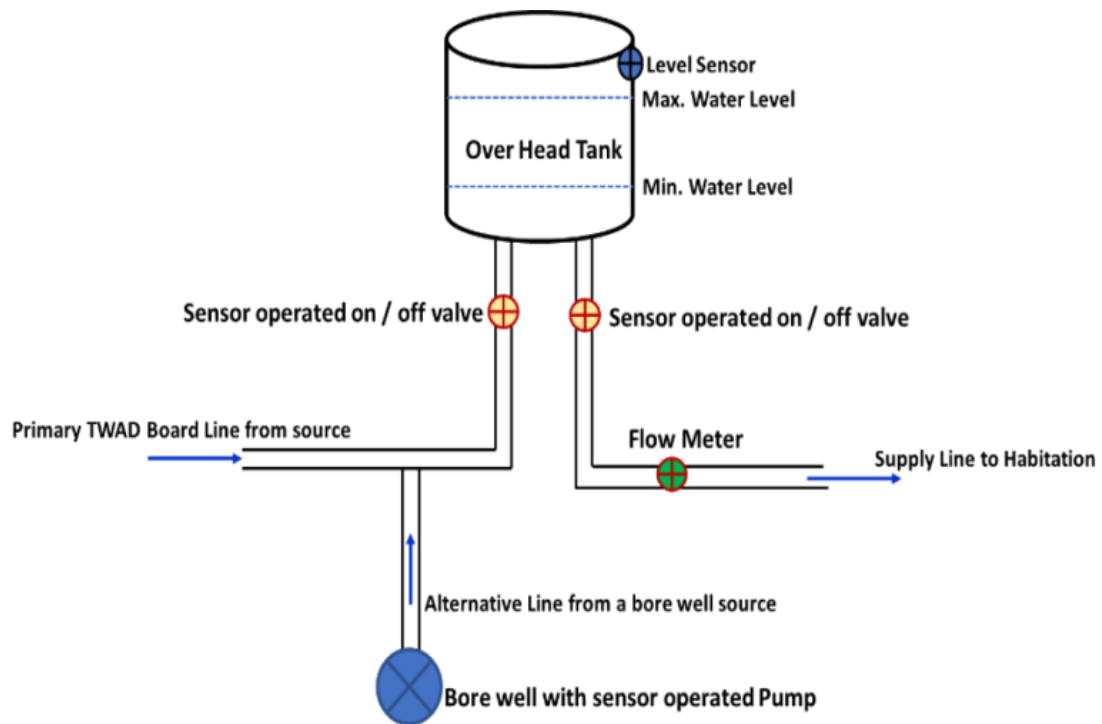
Prior to the installation of the IoT-based water management system, there was no automated mechanism to regulate water supply in the panchayat. The main sources of water supply were old Kaveri Scheme, new JJM Scheme and open wells. Besides, water was also taken from 12 bore wells, when water from primary sources was not adequate. Water is pumped to 16 overhead tanks from where it is distributed by gravity to the individual households.

Prior to the intervention, water samples were collected from all the sources and also from the overhead tanks and were analysed for water quality in the Environmental Engineering Laboratory of IIT Madras.

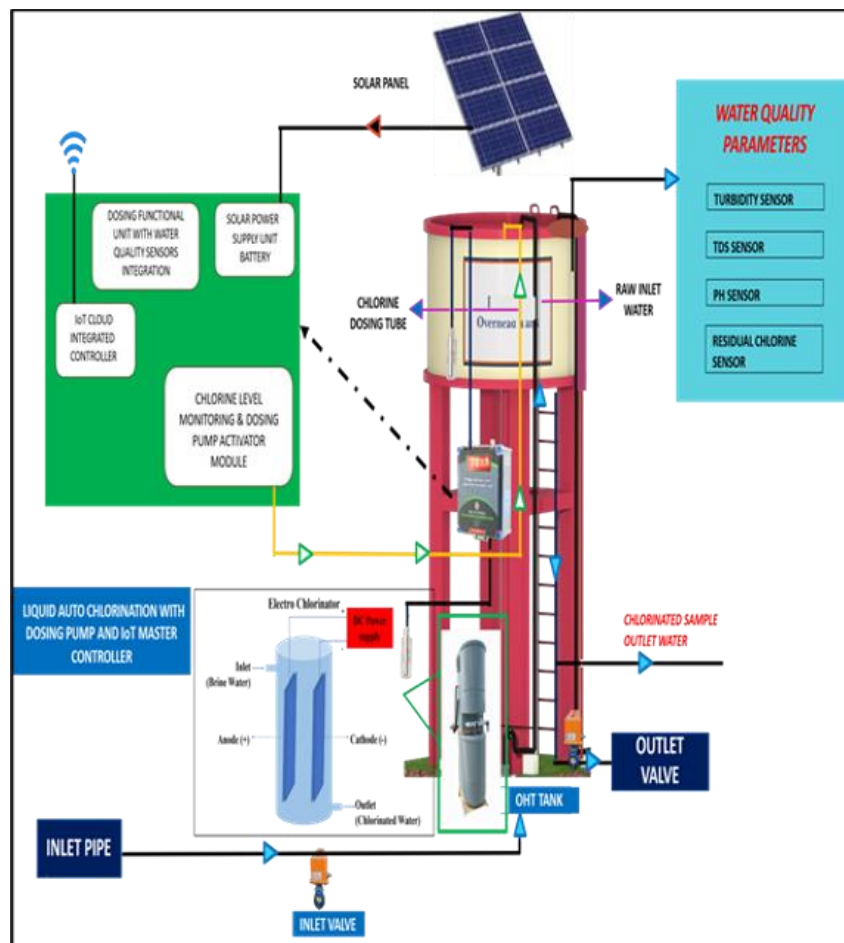
The water quality analysis results revealed that total and faecal coliforms exceeded the drinking water quality standards in several sources. Similar exceedances were also observed in water samples collected from all the OHTs. In addition, the Panchayat depends on alternative sources (bore wells and open wells) to supplement water supply as, many times, adequate amount of water is not available from the primary sources (TWAD Board water).

Schematic of IoT SYSTEM

The schematic and the photographs shown here represents a fully integrated IoT-based smart water supply, monitoring, and automated chlorination system designed around an Overhead Tank (OHT) for rural water distribution. Each overhead tank is fitted with the following IoT elements: (i) sensors for monitoring water quality; (ii) automatic chlorine dosing equipment; (iii) one level sensor to sense water level in the tank; (iv) one sensor controlled on / off valve on the inlet pipe; (v) one sensor controlled on / off valve on each supply line from the OHT; (vi) a sensor-based flow meter to record the amount of water supplied to the habitat; and (vii) a sensor-based pump in the alternative water source. It may be noted that the Panchayat is sourcing water from alternative sources (typically a bore or an open well). The pumping of water from this alternative source is carried out by Panchayat, whenever water from the primary source pumped by the TWAD Board is not available due to scarcity or any other reason. Automatic chlorination is carried out whenever the residual chlorine concentration falls below a critical value. All the operations, including the special requests, will be logged and tracked by a Mobile-based APP. The Mobile-based APP is provided to the Panchayat President / Secretary for enabling the operation.



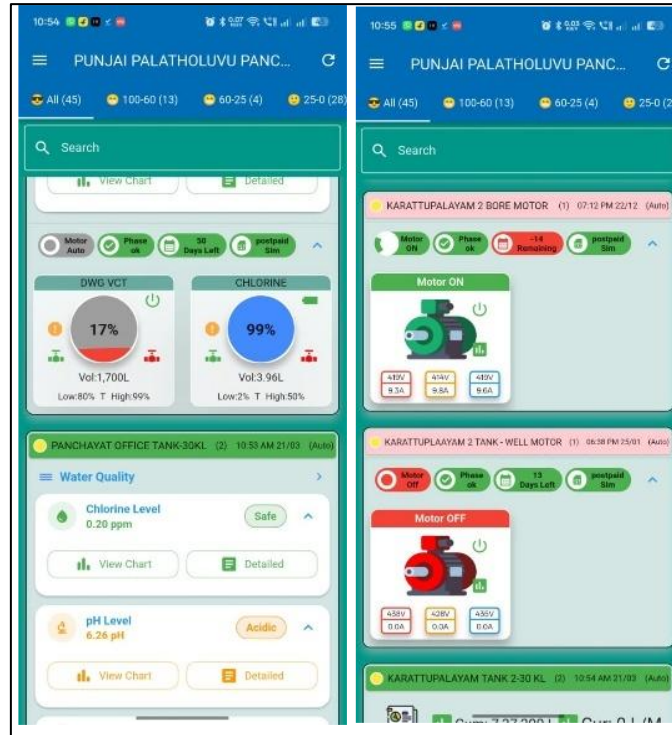
Schematic of an (OHT) Fitted with IoT



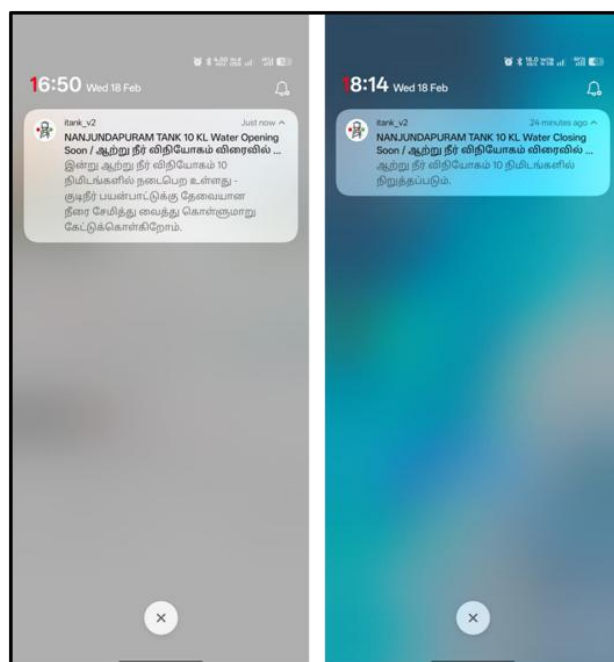


Salient Features of the Implemented IoT system

- Automated Pumping and Valve Control:** The system automatically controls pumping operations, including the opening of the gate valve to receive scheme water. The valve closes automatically when the overhead tank (OHT) reaches 80% of its storage capacity, thereby maintaining the tank level and preventing overflow.
- Solar-Powered Sensor Operation:** The IoT system is equipped with sensors that operate using solar energy, ensuring uninterrupted monitoring with minimal dependence on external power sources.
- Continuous Water Quality Monitoring:** Essential water quality parameters such as pH, turbidity, residual chlorine concentration, and total dissolved solids (TDS) are continuously monitored using sensors. The collected data are transmitted to the mobile application, and the readings are regularly reviewed by the AquaMAP team and the sensor service team. Periodic laboratory analysis of water samples was also carried out to verify sensor data.
- Real-Time Monitoring of Water Quantity:** Continuous monitoring of water quantity, including OHT water levels (expressed as a percentage of tank capacity) and the amount of water supplied, is displayed on a digital board attached to the OHT. The same information is also transmitted to the mobile application (i-Tank) for real-time monitoring.



- **Automated Chlorination System:** An electro-chlorinator automatically doses chlorine based on the volume of water in the OHT. The system checks the residual chlorine level every 30 minutes, and if the concentration is insufficient, additional chlorine is automatically added. This ensures that the residual chlorine concentration is maintained between 0.2 and 0.5 mg/L before water distribution.
- **Consumer Notification System:** Consumers receive push notifications on their mobile phones regarding the water distribution schedule, as well as information about whether the supply for the day is from scheme water or borewell water.



- **Grievance Redressal Support:** A toll-free number (90036 90038) is available for consumers to contact the IoT control room to report any issues related to water supply or water quality. Upon receiving complaints, the sensor service team takes immediate action to address the problem.

Pump and Electrical System

Many of the OHTs get their water from a secondary besides getting water from the primary source, which is under the control of TWAD Board. Pumping from the secondary source is carried out by the Panchayat, whenever water is not available from the primary source. This pump at the secondary source is provided with a controller, linking its operation to the water level in the OHT. Water level in the OHT is sensed by a water level sensor. The pump operation from the secondary source is automated based on tank levels and demand.

The automatic pump and valve operation is as follows:

- Under normal circumstances water pumped from Primary source fills the OHT
- The level sensor monitors the water level in the OHT
- If the water level is not up to maximum water level (adequate level) as indicated by level sensor by a pre-designated time, the pump from alternative source is automatically put on by the system.
- Once the water level in the tank reaches, the inlet valve to the tank is closed and simultaneously the pump at alternative source is switched off.
- The water is supplied from OHT to the habitat is supplied by opening the sensor controlled on / off valve during pre-designated times.
- The water is also supplied if any of the customers makes special request based on the special needs. The request is made by cell phone to the Panchayat President / Secretary and they can operate the valves remotely.
- Once the water level goes below the minimum water level in the OHT, the on / off valve on the inlet pipe automatically opens so that water either from the primary or secondary source can enter into the tank.

All the operations, including the special requests, are logged and tracked by a Mobile-based APP. The Mobile-based APP is provided to the Panchayat President / Secretary for enabling the operation.

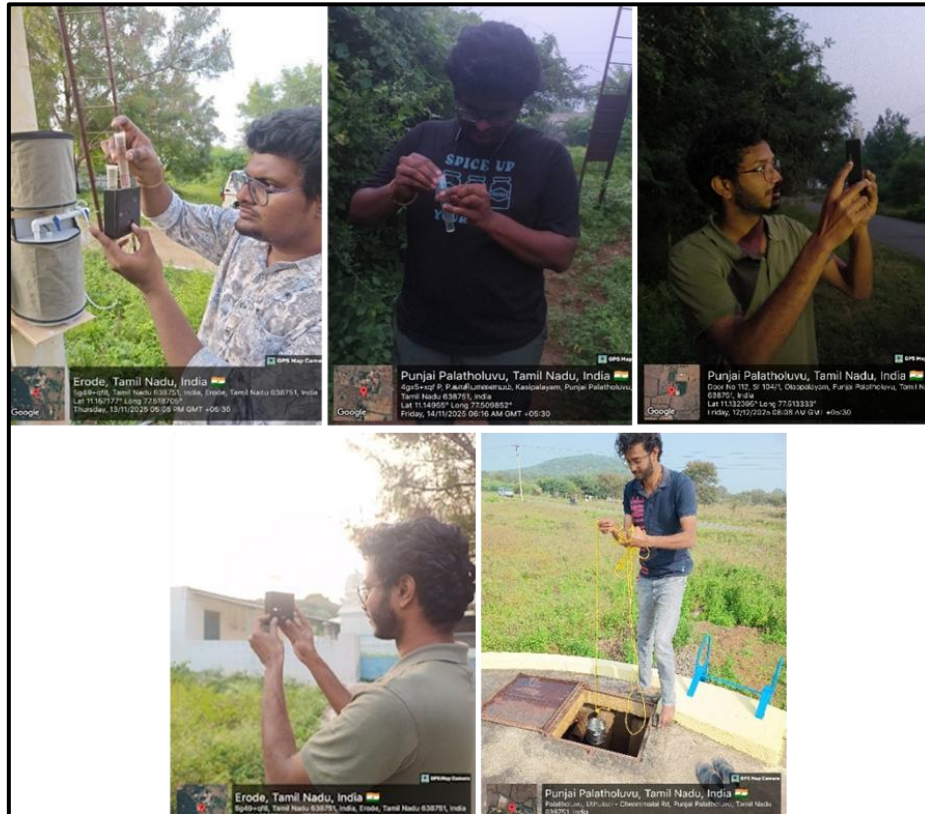
Solar Power Integration: A solar panel with battery backup is provided as the power source.

Communication System: A wireless communication system is put in place to ensure that all data from sensors and controllers is transmitted to the cloud using IoT communication protocols (e.g., GSM/Wi-Fi/LoRa). This enables remote supervision by authorities.

Post Implementation Assessment

Automatic Operation

The AquaMAP team monitored the automated water supply system at on three different dates: 29.09.2025, 14.11.2025, 12.12.2025 to ensure that the automation schedule operated reliably without human intervention.



Sensor Reliability Assessment

To evaluate the reliability of the sensors, water samples were collected repeatedly from the OHT and were analysed in the Environmental Engineering Laboratory of IIT Madras for water quality parameters.

Impact of IoT System

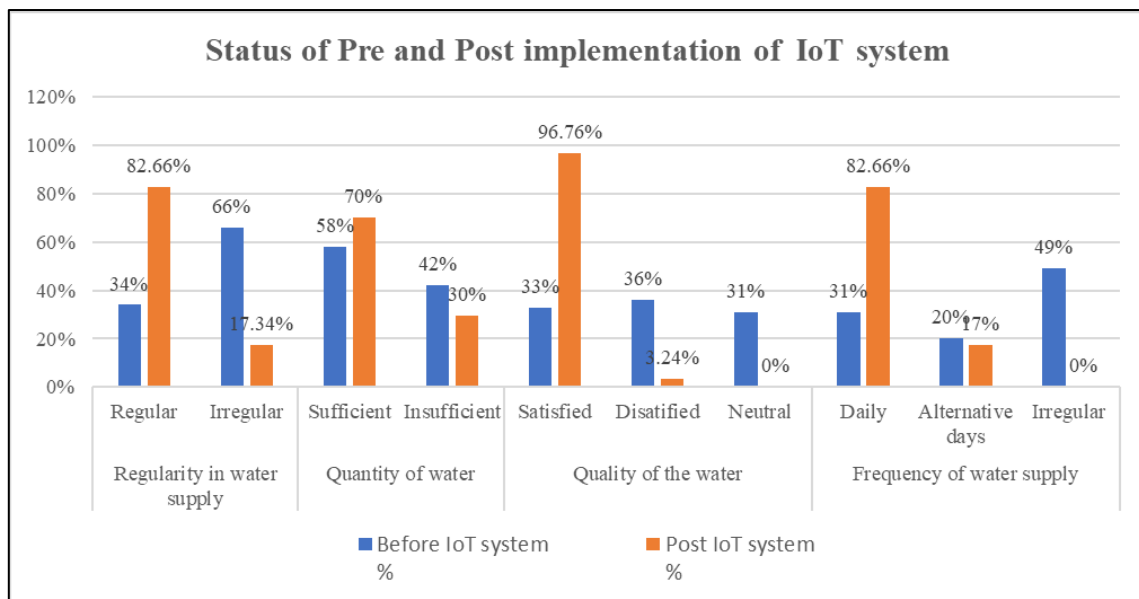
A structured survey was carried out in Punjai Palatholuvu Panchayat to evaluate the baseline conditions and measure the impact of IoT intervention in the water supply system. The study comprised both pre-implementation and post-implementation surveys to capture changes in service delivery, system performance, and user satisfaction.

The pre-implementation survey focused on understanding the existing challenges, including issues related to water availability, quality, supply reliability, and monitoring practices. Following the deployment of IoT-based solutions for real-time monitoring and management, a post-implementation survey was conducted to assess improvements in operational efficiency, transparency, and overall service outcomes.



Public Perception

An assessment of community feedback before and after the implementation of the IoT-based system indicates a significant improvement in user satisfaction. While earlier concerns were related to irregular water supply, uncertainty in timings, and lack of assurance on water quality, post-implementation feedback reflects increased reliability, better communication through consumer alerts, and enhanced confidence in the safety and consistency of the supplied water.



Findings

The implementation of the IoT-based smart water management system in Punjai Palatholuvu Panchayat has led to quantifiable improvements in water supply reliability, quality, operational efficiency, and user satisfaction. 867 households and a population of 2058 are directly benefited.

Following the IoT intervention, the system transitioned to a fully automated and monitored supply mechanism, resulting in **83% of households receiving daily water supply** with a consistent duration of approximately 60 minutes per day, and **75% user satisfaction with supply duration**. In terms of water quantity, **70% of households expressed satisfaction**, indicating a substantial improvement compared to pre-intervention conditions.

Water quality showed marked improvement, with **97% of users satisfied post-implementation, compared to only 47.4% satisfaction earlier**. The introduction of automated chlorination ensured residual chlorine levels maintained within 0.1–0.4 mg/L, significantly improving disinfection reliability and reducing health risks.

- The IoT-based system has significantly improved **reliability** and **consistency of water supply** through **automated scheduling** and **controlled distribution**.
- **Real-time monitoring** and **automated chlorination** have enhanced **water quality**, ensuring **safe drinking water** with maintained **residual chlorine levels**.
- The system has reduced **water wastage** through **optimized valve operations** and **regulated supply duration**.
- **Automation of pumps and dosing systems** has minimized **manual intervention**, reducing **operational errors** and **manpower dependency**.
- **Energy efficiency** has improved due to **optimized pump usage** and integration of **solar-powered backup systems**.
- Households have experienced **time savings**, eliminating the need to **wait for water** or **fetch from alternative sources**.
- The **consumer alert mechanism** has increased **transparency** by informing users about **start and stop of water supply** in advance.
- The system has improved **equity in water distribution**, ensuring **uniform access** across households.
- **Operational costs** have been reduced due to **efficient system management** and **lower maintenance requirements**.
- Overall, the intervention has resulted in **higher user satisfaction**, **increased trust in water quality**, and **improved public health outcomes**.

98% of households are now directly consuming supplied water without additional treatment, reflecting increased trust in water safety.

Handing Over

The system was formally handed over to the Punjai Palatholuvu Panchayat on 28th February 2026.

